DOCUMENT RESUME

ED 455 830 IR 020 853

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TITLE A User Analysis for Web-Based Distance Education.
PUB DATE 2001-00-00
NOTE 26p.; Paper presented at the Annual Topics on Distance Learning Conference (3rd, Hammond, IN, June 5-6, 2001).
AVAILABLE FROM For full text: http://www.calumet.purdue.edu/todl/proceedings/2001/2001proceedings.htm.
PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Comparative Analysis; *Computer Attitudes; Computer Literacy; *Computer Uses in Education; Distance Education; Educational Technology; Student Attitudes; Student Reaction; Users (Information); *World Wide Web
IDENTIFIERS *Web Based Instruction

ABSTRACT

This study identified direct and indirect effects of Web users' age, gender, technical training, computer and Web competencies, perceived usefulness of the Web, and perceived needs of the Web on their Web use. A theoretical model for the variables that affect individual differences in Web use was conceptualized through related literature and research reviews in the areas of computers, online networking, and the World Wide Web. In this study, an ex post facto design was employed to investigate factors that were related to Web use. Results revealed that there was a negative total effect of the age of participants on the amount of time spent using the Web. Also, their perceived needs of Web use, technical training they had received, perceived usefulness of the Web, and their computer and Web competencies had positive direct effects on their Web use. In particular, young participants spent more time using the Web and showed slightly more positive perception on the usefulness of the Web than more mature participants did. The results also showed that there were gender differences in the participants' computer and Web competencies in which the male participants showed a higher level of competency in Web use. Overall, the findings of this study suggest that basic skills and knowledge of Web use should be provided formally or informally to learners in order to facilitate the Web use for participants of Web-based instruction. It is also recommended that communication channels be provided for participants of Web-based instruction in order to facilitate their Web use. (Contains 85 references.) (Author/AEF)

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ED 455 830

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Conference Paper Presented at the 3rd Annual Topics on Distance Learning
Purdue University Calumet
Hammond, IN
June 5-6, 2001

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Abstract

This study identified direct and indirect effects of Web users' age, gender, technical training, computer and Web competencies, perceived usefulness of the Web, and perceived needs of the Web on their Web use. A theoretical model for the variables that affect individual differences in Web use was conceptualized through related literature and research review in the areas of computer, on-line networking, and the World Wide Web.

In this study, an ex post facto design was employed to investigate factors that were related to Web use. Results revealed that there was a negative total effect of the age of participants on the amount of time spent using the Web. Also, their perceived needs of Web use, technical training they had received, perceived usefulness of the Web, and their computer and Web competencies had positive direct effects on their Web use. In particular, young participants spent more time using the Web and showed slightly more positive perception on the usefulness of the Web than more mature participants did. The results also showed that there were gender differences in the participants' computer and Web competencies, in which the male participants showed a higher level of competency in Web use.

Overall, the findings of this study suggest that basic skills and knowledge of Web use should be provided formally or informally to learners in order to facilitate the Web use for participants of Web-based instruction. It is also recommended that communication channels be provided for participants of Web-based instruction in order to facilitate their Web use.

Introduction

The World Wide Web has been increasing dramatically in its popularity and accessibility due to the explosion of activities occurring on the Internet. The rapid growth of the World Wide Web has changed the "fundamental way to create, manipulate, store, retrieve, transfer, and utilize information" (Bruce, 1998, p.541) and has offered colossal potential for many fields, from education and training to entertainment (Alexander, 1995; Khan, 1997).

In recent years, the World Wide Web has been described as an "information superhighway" (Bruce, 1998), and a "universal panacea for information searching" (Smith, Newman, & Arks, 1997). The Internet started from 213 hosts (any computer system connected to the Internet) in 1981, and by July of 2000 there were 93 million hosts, representing an increase of 426,824 times over the last two decades (Wizard, 2000). It is estimated that there are currently over 400 million users in the world (NUA Internet Survey, 2000).

In particular, as society has entered the information era, there are increasing societal needs for life-long learning (Daniel, 1998) and commercial portal Web sites that list online courses available through various colleges, universities, and other institutions are booming (Carr, 2000). Also, industries have been rapidly adopting the World Wide Web technology in training their employees (Training Magazine, 2000).

As the popularity of the World Wide Web increases, the tremendous potential of the World Wide Web for education and training has been suggested by many researchers (Anderson, 1997; Crossman, 1997; Jonassen, 1986, 1988; 1989; Jonassen et al., 1997; Khan, 1997; Marchionini, 1988; Oliver & Oliver, 1996; Riddle, Nott, &

Pearce, 1995). From the beginning, many researchers attempted to utilize the Web's capabilities for teaching and learning, and the World Wide Web has become ubiquitous in education not only for learning and teaching but also for library services and school administration (Crossman, 1997; Gabbard, 2000; Khan, 1997; Oliver & Oliver, 1996; Riddle et al., 1995; Soberberg, 2000).

However, as Davidson (1995) states "as educators, we would never consider gathering a collection of texts, audio-visuals, and other reference material and simply dropping them in a heap on a table, and expect our students to "learn" from them"; in other words, simply publishing an electronic course or information on the World Wide Web with links to other pages or other digital resources does not constitute instruction (Khan, 1997; Peraya, 1998). Rather, designing and delivering instruction on the Web requires thoughtful analysis and investigation on how users interact with the Web (Khan, 1997).

New technologies and media have been popular research areas to educators and researchers throughout the history of education. Even though technologies as delivery systems have been considered so crucial to effective learning and teaching, research on media and technology has been driven by practice, rather than influencing it. Research in this area has focused on media or technology comparison studies, descriptive studies, and evaluation reports. While media comparison studies may be useful for making media selection, in fact, they do not contribute much to understanding of technology as a delivery system in education (Clark, 1983; Herschback, 1984; McClelland & Saeed, 1986; Moore & Kearsley, 1997; Schrum, 1999). Therefore, the new focus of research in media and technology has shifted toward learner characteristics as these are believed to be more useful and appropriate factors related to learning (Dillon & Gabbard, 1998;

Dillon & Watson; 1996; Moore & Kearsley, 1997; Russell, 1997; Schrum, 1999). For instance, after analyzing extensive experimental evidence in hypermedia, Dillon and Gabbard (1998) stated the learner characteristic as one of the most important areas for future research.

Also, in the field of instructional design, learner analysis, which follows the initial stage of identifying the need for instruction, is considered to be one of the most critical steps in the instructional design process. There are several factors that are crucial for pedagogical decisions in the instructional design process (Hajizainuddin, 1999), and these factors include learners' general characteristics, their specific entry behavior, and their learning styles (Heinich, 1996).

Background

Even though there is an ample amount of research on the factors that affect computer use, few studies have dealt with the use of the World Wide Web. However, previous studies provide a theoretical model for investigating the factors that influence the use of the World Wide Web.

Previous research on computer and new technology examined a variety of factors related to Web use, and gender is one of the most popular factors among them. However, there has been no clear consensus on the results of the studies. Previous studies found significant gender differences in computer learning and competency (Abler & Sedlacek, 1989; Feltler, 1985; Harrison & Rainer, 1992; Swanders & Jarret, 1986; Wilder, MacKie, & Cooper, 1985), attitude toward computer use (Chen, 1986; Collis, 1988; Comber, Colley, Hargreaves, & Dorn, 1997; Huges, MacLeod, Potts, & Rodgers, 1985; Koohang, 1989; Levin & Gordon, 1989; Loyd & Gressard, 1986;

Massoud, 1991; Miura, 1987; Richards, Johnson, & Johnson, 1986; Young, 2000), experiences in computer use, (Comber et al., 1997; Young, 2000), computer activity preference (Lockheed & Frakt, 1984), technostress (Elder, Gardner, & Ruth, 1987), and Web use (Teo & Lim, 2000), whereas there were findings that showed no significant difference between genders in terms of attitude toward computer (Koohang, 1989; Marshall & Bannon, 1986), the amount of computer use (Kay, 1990), and the ability of computer programming (Webb, 1985).

Recent research indeed shows that the number of women using the Internet has increased dramatically (Media Metrix, 1999; Nielsen Media Research, 1999; U.S. News & World Report, 1995). However, there is still a gender difference in the Web use (Teo & Lim, 2000), despite the tendency of increase in women's Web use.

One of the most important factors for users concerning the use of the Web is whether the Web site satisfies the user's need (Rogers & Shoemaker, 1971). While there have not been many empirical studies on users' perceived need of computers and their use of the Web, findings to date show that users' perceived need of technology has an influence on their adoption of new technology. For instance, a study by Marshall (1990) shows that the perceived need by users is a strong predictor of the adoption of new technology, and Robinson (1995) states that unless users have specific needs for using new technology, they would not adopt it.

Many studies have verified the importance of technical support for new technology and Web-based learning. Jorde-Bloom and Ford (1988) posited that the high level of support for new technology had a positive impact on the individual's decision on its adoption. Technical support for hardware and software also has an effect on Web-based distance education (Hara, 1998) and technology integration (Hoffman, 1996;

Roberts & Ferris, 1994). In addition, failure to locate such supports and to control them appropriately can result in an inevitable fiasco. Mruk (1984) reported that support for learning to use computers had an influence on computer use in adult computer training.

Many studies have shown the importance of the impacts of users' experience and competency on their attitude toward computer use (Koohang, 1986, 1987, 1989; Koohang & Byrd, 1987; Tamar Levin & Claire Gordon, 1989; Loyd & Gressard, 1984), computer use in computer-based learning (Hall & Cooper, 1991; Levin & Gordon, 1989; Marcoulides, 1988; Martin & Lundstorm, 1988), computer use (Harold, 1992; Shawareb, 1993), perceived computer usefulness (Campbell & Williams, 1990), and Web-based instruction (Hajizainuddin, 1999; Hara, 1998).

Many researchers have studied on the effects of technical training and support that users receive, and their computer competency on their computer use. Yildirim (1997) reported that there was a significant correlation between the number of technical training users had received and their computer competencies Computer competency and technical training were positively related to computer use in the classroom (Shawareb, 1993) and computer-based learning (Shin, Schaller, & Savenye, 1994). Meltzer and Sherman (1997) also posit that providing technical training and support are critical to the successful integration of technology for users. Marcoulides (1988) argues that the lack of knowledge in computer creates the anxiety on its use and increasing familiarity with computers is important for computer use. Roberts and Ferris (1994) found that teachers' knowledge in computer is an important factor for them to integrate computers into their classrooms.

Based on the findings of previous studies on the use of computers and the Web, the purpose of this study is to investigate the relationships of such factors as users' age,

gender, the amount of technology training they received, their perceived need and usefulness of the Web, and their computer competency to th ır Web use.

Method

Sample

The sample for this study was drawn from DACOM Chollian users. DACOM Chollian is a Korean networking company that provides online services and Internet PPP. Through log-on user searching, the sample was selected from the users who logged onto the Internet service from 5:00 p.m. to 9:00 p.m. on October 15 in 2000. The sample includes a wide range of backgrounds in terms of age, profession, and educational level. E-mail messages soliciting the permission to participate in the study were sent to 785 users and electronic questionnaire was sent by e-mail to 350 members who consented to participate in the study. As the result, 257 questionnaires were returned, yielding a response rate of 73.4%.

Instruments

The instruments of this study consist of two sections: demographic and factor measurements. The demographic section asked the participants' age, gender, profession, the amount of weekly use of the Web, the amount and the kinds of technical training they had received, and open-ended questions on their knowledge of computers and the Web. The later section consisted of the questions about their perceived needs of the Web use, their perceived usefulness of the Web, and their competencies in computer and Web use. The instrument to measure factors was modified from the survey created by Harold (1992). The question items regarding their perceived usefulness of the Web consisted of six question items, and there were also four question items regarding their perceived needs of Web use. The question items regarding computer and Web

competency consisted of nine categories; word processing, database management, spreadsheets, presentation software, communication, Web browsing, desktop publishing, computer language, and game. Participants were asked to rate their competency on the questionnaire, and each item in the questionnaire used a five-point Likert scale.

The Causal Models and Data Analysis

A causal model that structures a theoretical ordering of variables in terms of their effects on other variables was developed through the review of relevant studies. Path analysis was used to analyze the causal models in order to differentiate between direct and indirect effects of selected variables on the use of the Web. Simultaneous regression equations were employed to assess the significance of the relationships. Pearson correlation analysis was used to analyze the strength of the relationship between each independent and dependent variables in the causal models. A comparison of the path coefficients examined the relative importance that the exogenous (age and gender) and endogenous variables (computer and web competency, perceived usefulness of the Web, perceived need of the Web, support) had on users' Web use.

Results

Table 1 shows the results of the path analysis for indirect and direct effects and Pearson correlation coefficients among the variables being studied. The path analysis model that was used to analyze the relationships among the variables is depicted in Figure 1. The total effects and Pearson correlation coefficients are also shown in this model. The major research interest in this study was in the magnitude of direct and indirect effects of the variables on the participants' use of the Web.

The result of the first structural equation shows that age ($r = -.29$, $p < .01$), perceived need of the Web ($r = .48$, $p < .01$), perceived usefulness of the Web ($r = .29$, $p < .01$), computer competency ($r = .32$, $p < .01$), and technical training ($r = .29$, $p < .01$) have significant correlations with their Web use. The total effects on Web use were perceived need (.46), computer competency (.37), technical training (.31), and age (-.14). Age had only an indirect effect on Web use. The gender variable failed to achieve a significant path coefficient.

The result also shows that computer competency was negatively related to age ($r = -.29$, $p < .01$; and gender ($r = -.22$, $p < .05$). The total effects of age (-.28) and gender (-.26) also showed significant relationship at the .01 level. However, there was no significant correlation between computer competency use and perceived need of the Web. Perceived usefulness of the Web also failed to achieve a significant path coefficient.

The amount of technical training that the participants had received was correlated only with gender ($r = -.23$, $p < .01$) with a direct effect of -.19. The path analysis showed that the amount of technical trainings that the participants had received was not significantly correlated with their age, their perceived need and usefulness of the Web.

Age was also significantly correlated with the participants' perceived usefulness of the Web ($r = -.19$, $p < .05$) and their perceived need of Web use ($r = -.18$, $p < .05$). The direct effect of age on perceived usefulness of the Web was -.15, and its direct effect on the perceived usefulness of the Web was -.13. However, no significant relationship was found between gender and the perceived need of the Web and perceived usefulness of the Web.

Discussion

Findings reveal that there are important factors that influence the degree of Web use. However, not all factors have direct effects on Web use. Age was an important factor that had an effect on the participants' Web use and also on other variables. The total effects of age had a negative relationship on the amount of Web use, perceived need of the Web, perceived usefulness of the Web, and computer competency. In particular, younger participants were more likely to spend more time using the Web than older participants, and they were more likely to perceive the need of Web. The younger participants also rated themselves as having more computer competency.

Many researchers have reported similar results on the use of computers. Harold (1992) found significant difference between the age of professors of adult education and the amount of time spent on using computers. Mathews (2000) also found a significant difference between age of teachers in Idaho school districts and their use of the computer. Korgaonkar (1999) also found that younger Web users spent more time on the Web than older Web users for personal use. However, for business purposes, older Web users were more likely to make Web purchases.

Even though there was no significant difference between gender and the use of the Web, gender differences were found in computer competency and technical training. The result showed that the male participants rated themselves as having higher computer competency than female. Male participants were also more likely to take technical training than female. This finding confirms the findings of previous research which reported the male dominance phenomenon in the computer related field (Herring, Johnson, & DiBenedetto, 1995; Mathews, 2000).

The finding also showed that the participants' computer competency level has a positive impact on the amount of their Web use. This finding is consistent with the previous studies on the computer use by Dusick and Yildirim (2000), and Mathews (2000).

Participants' perception on the need of Web was a strong predictor of their Web use. The direct effect of their perception on the need of Web use was .46 at .001 level. The amount of technical training the participants had received also influenced the amount of Web use (T.E = .31, $p < .001$). Dusick and Yildirim (2000)'s study on college faculty members also showed that their computer competency level was positively related to the amount of training courses that they had taken.

In sum, the study found out that the participants' perceived need of Web use and its usefulness, the amount of technical training they had received, their computer competency level, and age had significant effects on their Web use. However, gender did not influence their Web use significantly.

Implications

In order to facilitate the use of the Web, users need to perceive the potential of the Web use so that they could formulate a need and value of the Web use. Also, improvements in their computer and Web competency also should be made through technical training to encourage their effective Web use.

Participants responded that not only formal technical training sessions and workshops but also informal learning, such as learning from colleagues, friends, and the resources on the Web were helpful to learn and use the Web. Therefore, basic skills and knowledge for using the Web could be provided either formally or informally in order

to facilitate the Web use for Web-based instruction. It is also suggested that communication channels between users or participants of a Web site is necessary in order to facilitate their Web use.

Online instructors have to play multiple roles, which are distinctive from traditional classroom instructor' roles; i.e. they have to provide learners with technical, social, and managerial support as well as pedagogical support (Ursery & Meacham, 2001). As the use of the Internet becomes more popular, and the need for life-long learning increases, the population of Web users will become more diverse with diverse. Therefore, online instructors should be aware of the individual differences in Web use, and provide the learners support for those who need remedial training for their Web competency.

Also, at the institutional level, the learner support system is needed to assess individual's need for remedial training on the Web use and also to provide the learner with the training that meets the individual's needs. In addition, comfort level with technology is an important barrier to faculty's participation in online teaching (Freberg, 1995; Garrison,1990; Schifter, 2000), and McIsaac and Gunawardena (1996) found out that lack of training opportunity for faculty affected their dissatisfaction with teaching distance courses. Therefore, institutions offering distributed education need to provide instructional and technical support for the faculty regarding their Web use.

Table 1. Decomposition of effects from the Path Analysis of the reduced model

Effect		Causal Effect		
	R	Direct	Indirect	Total
On Training				
By Age	-.12	-.09	-.00	-.09
By Gender	-.23**	-.19*	.00	-.19**
By Need	.17*	.07	.03	.10
By Usefulness	.09	.03	.00	.03
On Usefulness				
By Age	-.19*	-.15*	.00	-.15*
By Gender	.09	.03	.00	.03
On Need				
By Age	-.18*	-.13*	.00	-.13*
By Gender	-.11	-.04	.00	-.04
On Computer competency	-.29**	-.19	-.09	-.28**
By Age	-.22*	-.21*	-.05	-.26**
By Gender	.13	.04	.00	.04
By Need	.08	.03	.00	.03
By Usefulness				
On Use				
By Age	-.29**	.03	-.17*	-.14*
By Gender	-.11	.04	-.09	-.05
By Need	.42**	.39**	.07	.46**
By Training	.28**	.28**	.03	.31**
By Usefulness	.29**	.24**	.00	.24**
By Computer Competency	.32**	.26**	.11	.37**

* $p < .05$. ** $p < .01$

Figure 1. Path coefficients and Pearson r Coefficients for the Model

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